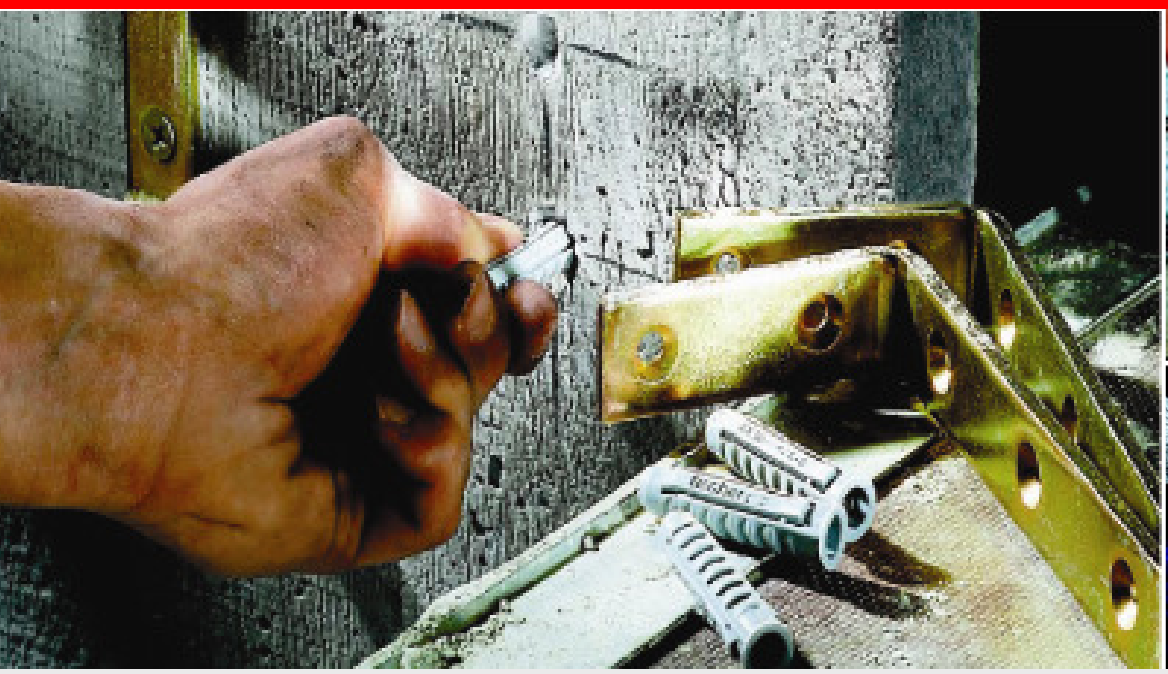
fischer Test Report



Fixing Tests for

THERMALITE

fischer
FIXING SYSTEMS

Testing into Thermalite blocks

1 Introduction

THERMALITE

Ref./.. JHF/thm.0151

Thursday, 21 November 2002

Fischer Fixings
Artur fischer (UK) Ltd
Hithercroft Road
Wallingford
Oxfordshire
OX109AT

We confirm that the tests as detailed in your document titled 'Fixing Test Report for Thermalite' were carried out at Artur Fischer's test facilities in Wallingford, Oxfordshire.

The tests were carried out on individual blocks of Thermalite products Turbo, Shield, Party Wall and Hi-Strength 7.

These results are a true record of the tests, therefore, we can recommend that the fixings describe are suitable for use in our products, up to the safe working loads stated.

Yours sincerely
Marley Building Materials Limited

Chris Hornby
Technical Manager

1.2 Test Parameters

Various fixings were tested into four different types of Thermalite blocks; Turbo, Shield, Party Wall and Hi-Strength 7. The fixings were installed and tested in individual blocks not walls. To achieve fair and conservative test results all tests were carried out into 100mm thick blocks. Higher loads would be achievable if thicker blocks were used but, unfortunately, this is not always the case on construction sites.

The tests were carried out at:

fischer Fixings UK Ltd
Hithercroft Road
Wallingford
Oxfordshire
OX10 9AT

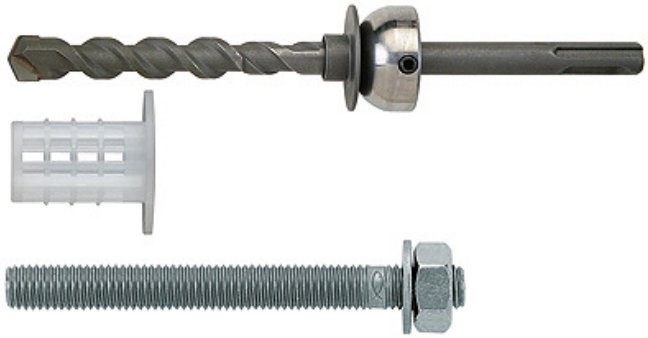
All tests were carried out using a calibrated 20kN Hydrajaws tensile tester. To conform to CFA (Construction Fixing Association) guidelines each type of fixing was tested six times.

2 Fixing Products tested.

2.1 Fischer PBB Undercut Anchor System

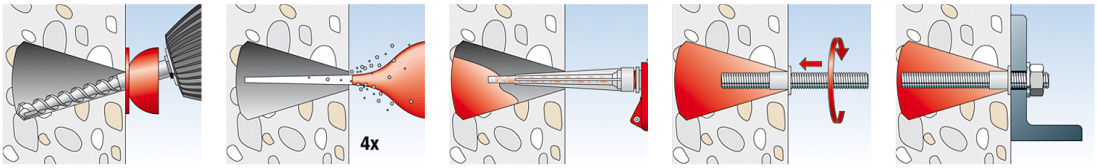
Material: Cone Drill PBB, Centering Sleeve PBZ, FIS V 360 S Resin

Range:M8 – M12



The PBB undercut anchor system is designed specifically for aircrete with FISV resin and threaded rod. The special PBB drill produces a conical hole, which when filled with resin, produces a mechanical interlock which guarantees maximum load bearing capacity with stress free installation.

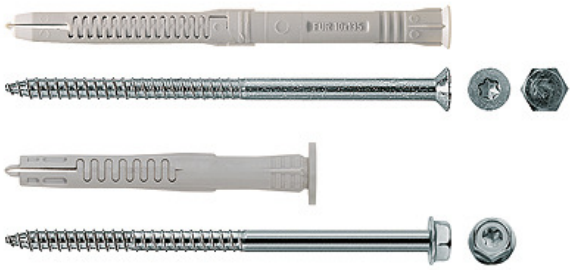
In order for the stud to remain central within the hole a plastic centering sleeve is placed in the mouth of the conical hole.



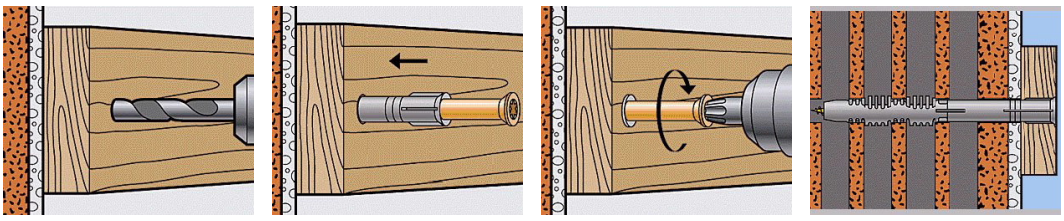
2.2 fischer FUR Universal Frame Fixing

Material:	Plug -	Nylon (polyamide 6)
	Screw -	Steel grade 6.8 or A4 Stainless steel

Range:	FUR 8, 10 & 14mm diameter
	Hexagon or countersunk head
	Zinc plated or stainless steel
	80-270mm long



The fischer FUR sets a new standard for frame fixing. Its innovative expansion section results in the FUR being suitable for virtually all construction materials with high loads and optimum reliability. Anchorage in solid materials is by friction locking. The close-set teeth provide ideal expansion of the fixing in solid substrates, ensuring constant expansion force along the entire anchorage length. The close-set teeth expand and form lock in hollow materials.

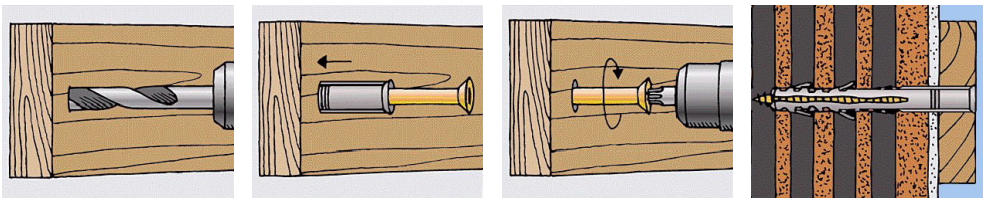


2.3 fischer S-H-R Frame Fixing

Material:	Plug -	Nylon (polyamide 6)
	Screw -	Steel grade 5.8
Range:	8, 10 & 14mm diameter	
	Zinc plated or stainless steel	
	80-360mm long	

The S-H-R frame fixing operates in the more common two-way expansion, but due to the longer expansion section a deeper embedment depth is used, increasing the load bearing capability in hollow and softer substrates.

The S-H-R frame fixing has an ancillary tool known as GBS hole punch. The GBS has been specifically designed for lightweight substrates. The hole punch has a SDS drive adapter, so it can been used with a hammer drill, and the anti-rotational chuck prevents any rotational movement allowing the GBS hole punch to vibrate it's way through the block. This in turn compresses the excavated material against the walls, resulting in the walls of the hole being more dense and, therefore, more suitable for fixing into.

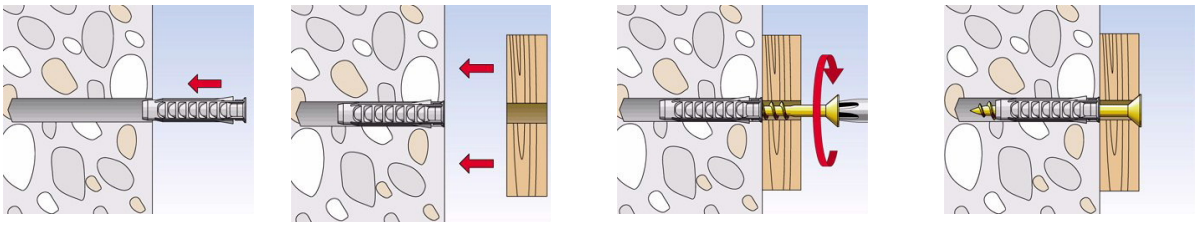


2.4 fischer SX with fischer Safety Screw

Material:	Plug -	Nylon (polyamide 6)
	Screw -	Metal grade 6.8
Range:	SX4-16	

The fischer SX plug has a four-way expansion section compared to conventional two-way expansion plugs. This unique four-way expansion gives a greater load capacity, as the surface area in contact with the substrate is much greater than with standard plugs. Therefore, the SX plug is designed for both solid and hollow building materials.

Not only can the SX be installed as a flush fixing, but it can also be installed as a through fixing due to its retaining collar and 'knock-in' lock effect just below the collar. This prevents the plug from expanding prematurely when the plug and screw are being hammered through the fixture towards the surface of the building material.



3 Results

3.1 FIS V + PBB + M10

Turbo 2.8N/mm²

Test No.	Load in kN	Characteristic axial spacing
1	4.8	200
2	4.1	200
3	4.8	200
4	4.3	200
5	5.2	200
6	4.4	200
Average	**4.60**	

Using a global safety factor of 4 = **1.15**

Shield 4.0N/mm²

Test No.	Load in kN	Characteristic axial spacing
1	4.6	200
2	4.0	200
3	3.9	200
4	3.9	200
5	3.4	200
6	3.6	200
Average	**3.90**	

Using a global safety factor of 4 = **0.97**

Party Wall 4.0N/mm²

Test No.	Load in kN	Characteristic axial spacing
1	3.9	200
2	4.4	200
3	3.1	200
4	3.9	200
5	3.8	200
6	4.4	200
Average	**3.92**	

Using a global safety factor of 4 = **0.98**

Hi-Strength 7 7.0N/mm²

Test No.	Load in kN	Characteristic axial spacing
1	7.1	200
2	6.5	200
3	8.1	200
4	8.0	200
5	7.1	200
6	6.0	200
Average	**7.13**	

Using a global safety factor of 4 = **1.78**

3.2 FIS V +PBB + M12

Turbo 2.8N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	6,0	250
2	5,0	250
3	5,1	250
4	5,9	250
5	5,0	250
6	4,8	250
Average	**5.30**	

Using a global safety factor of 4 = **1.32**

Shield 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	4.2	250
2	4.3	250
3	5.0	250
4	4.1	250
5	4.1	250
6	5.1	250
Average	**4.46**	

Using a global safety factor of 4 = **1.12**

Party Wall 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	4.2	250
2	4.1	250
3	4.9	250
4	5.5	250
5	7.0	250
6	6.5	250
Average	**5.36**	

Using a global safety factor of 4 = **1.34**

Hi-Strength 7 7.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
	9.0	250
	8.3	250
	7.8	250
	8.5	250
	8.1	250
	7.1	250
Average	**8.13**	

Using a global safety factor of 4 = **2.03**

3.3 FUR 8

Turbo 2.8N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	1.9	210
2	1.8	210
3	1.9	210
4	1.8	210
5	1.8	210
6	2.0	210
Average	**1.87**	

Using a global safety factor of 7 = **0.27**

Shield 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	2.75	210
2	2.4	210
3	2.0	210
4	1.5	210
5	2.8	210
6	1.6	210
Average	**2.18**	

Using a global safety factor of 7 = **0.31**

Party Wall 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	2.2	210
2	2.1	210
3	2.6	210
4	2.4	210
5	2.4	210
6	1.8	210
Average	**2.25**	

Using a global safety factor of 7 = **0.32**

Hi-Strength 7 7.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	1.5	210
2	2.2	210
3	2.4	210
4	2.4	210
5	2.0	210
6	2.0	210
Average	**2.08**	

Using a global safety factor of 7 = **0.52**

3.4 FUR 10

Turbo 2.8N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	2.6	210
2	2.0	210
3	2.1	210
4	1.9	210
5	2.5	210
6	2.3	210
Average	**2.23**	

Using a global safety factor of 7 = **0.32**

Shield 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	2.8	210
2	2.3	210
3	2.7	210
4	2.2	210
5	2.0	210
6	2.1	210
Average	**2.35**	

Using a global safety factor of 7 = **0.33**

Party Wall 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	4.0	210
2	3.0	210
3	3.1	210
4	3.0	210
5	2.2	210
6	3.3	210
Average	**3.1**	

Using a global safety factor of 7 = **0.44**

Hi-Strength 7 7.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	3.8	210
2	3.3	210
3	3.7	210
4	3.2	210
5	3.0	210
6	3.1	210
Average	**3.35**	

Using a global safety factor of 7 = **0.84**

3.5 S-H-R

Turbo 2.8N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	1.8	210
2	1.9	210
3	1.4	210
4	1.8	210
5	1.6	210
6	1.8	210
Average	**1.72**	

Using a global safety factor of 7 = **0.24**

Shield 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	2.0	210
2	2.4	210
3	1.8	210
4	1.6	210
5	1.4	210
6	1.6	210
Average	**1.80**	

Using a global safety factor of 7 = **0.26**

Party Wall 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	2.2	210
2	2.2	210
3	2.0	210
4	2.4	210
5	2.4	210
6	2.4	210
Average	**2.27**	

Using a global safety factor of 7 = **0.32**

Hi-Strength 7 7.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	2.4	210
2	2.8	210
3	2.6	210
4	2.0	210
5	2.4	210
6	2.6	210
Average	**2.47**	

Using a global safety factor of 7 = **0.32**

3.6 SX8 with Safety screw

Turbo 2.8N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	0.8	120
2	0.7	120
3	0.5	120
4	0.8	120
5	0.9	120
6	0.7	120
Average	**0.73**	

Using a global safety factor of 7 = **0.10**

Shield 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	1.1	120
2	1.1	120
3	1.1	120
4	1.1	120
5	1.2	120
6	1.2	120
Average	**1.13**	

Using a global safety factor of 7 = **0.16**

Party Wall 4.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	1.1	120
2	1.2	120
3	1.2	120
4	1.2	120
5	1.2	120
6	1.2	120
Average	**1.18**	

Using a global safety factor of 7 = **0.17**

Hi-Strength 7 7.0N/mm^2

Test No.	Load in kN	Characteristic axial spacing
1	2.8	120
2	2.2	120
3	2.9	120
4	2.8	120
5	2.6	120
6	2.8	120
Average	**2.68**	

Using a global safety factor of 7 = **0.67**

3.7 SX10 with Safety Screw

Turbo 2.8N/mm²

Test No.	Load in kN	Characteristic axial spacing
1	2.2	150
2	1.9	150
3	2.3	150
4	2.1	150
5	2.0	150
6	2.0	150
Average	**2.08**	

Using a global safety factor of 7 = **0.30**

Shield 4.0N/mm²

Test No.	Load in kN	Characteristic axial spacing
1	1.7	150
2	1.8	150
3	1.8	150
4	2.0	150
5	1.6	150
6	1.8	150
Average	**1.78**	

Using a global safety factor of 7 = **0.25**

Party Wall 4.0N/mm²

Test No.	Load in kN	Characteristic axial spacing
1	2.8	150
2	2.9	150
3	1.9	150
4	2.0	150
5	2.6	150
6	2.8	150
Average	**2.5**	

Using a global safety factor of 7 = **0.36**

Hi-Strength 7 7.0N/mm²

Test No.	Load in kN	Characteristic axial spacing
1	3.0	150
2	4.0	150
3	4.0	150
4	4.2	150
5	3.5	150
6	3.7	150
Average	**3.73**	

Using a global safety factor of 7 = **0.93**

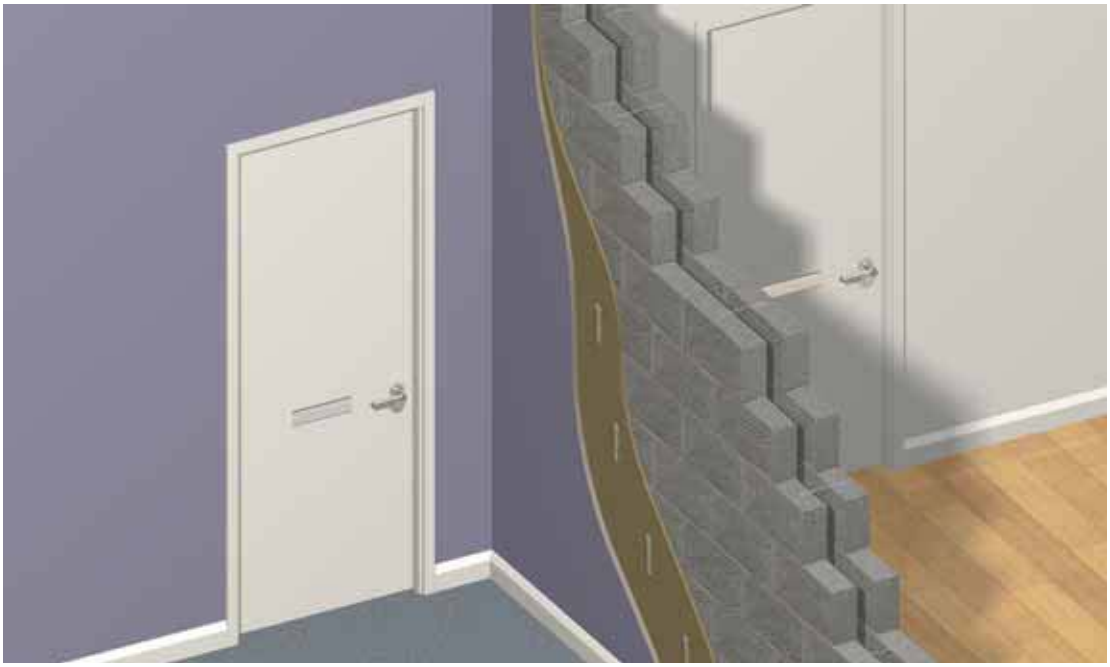
Party Wall

separating walls • partitions • external walls • foundations

Strength 4.0N/mm²

Thermal conductivity 0.16W/m.K

Density 660kg/m³



Party Wall is a lightweight concrete block that gives high levels of sound reduction in separating walls between buildings.

- Suitable for both cavity and solid wall constructions
- Available in large format
- For use with Thermalite Thin Layer Mortar

Working dimensions

Face dimensions (mm) 440 x 215, 440 x 430*

Tolerances

- For general purpose mortar:
  Length: + 3mm, - 5mm
  Width: ± 2mm
  Height: + 3mm, - 5mm
- For thin layer mortar:
  Length: ± 3mm
  Width: ± 2mm
  Height: ± 1.5mm

Properties

Mean compressive strength not less than 4.0N/mm²

Designed thermal conductivity (λ) 0.16W/m.K

Specified gross dry density 660kg/m³

* Manufactured to special order only

Widths and weights

Block weights at equilibrium density (for 440 x 215mm face dimension)		
block width (mm)	100	215
block weight† (kg)	6.4	13.8
wall weight‡ (kg/m²)	76	163

† Block weights are calculated using specified gross dry density, with a moisture content of 3% by weight added to provide the equilibrium value.

‡ Weight of erected wall (including mortar). Add 11kg/m² per side for a 2-coat lightweight plaster finish (24kg/m² for dense plaster).

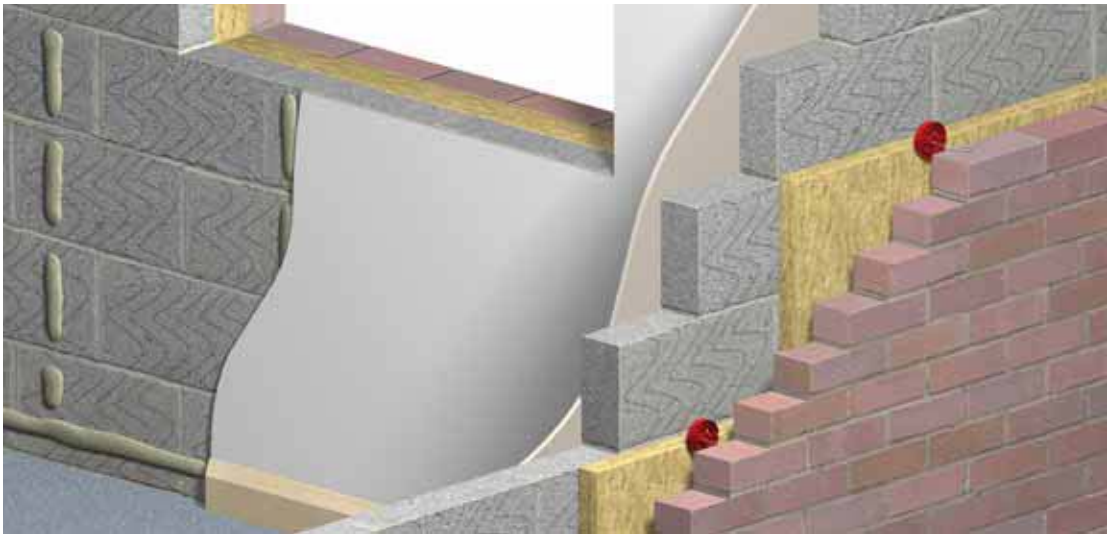
Turbo

external walls • foundations • partitions

Strength 2.9N/mm²

Thermal conductivity 0.11W/m.K

Density 470kg/m³



Turbo offers very high thermal insulation properties and is therefore ideal for external solid wall applications (min. block thickness 215mm) where low U-Values are required.

- Available in large format
- For use with Thermalite Thin Layer Mortar
- Use only in soils up to Design Sulfate Class DS 3* below ground

Working dimensions

Face dimensions (mm) 440 x 215, 440 x 430

Tolerances

- For general purpose mortar:
  Length: + 3mm, - 5mm
  Width: ± 2mm
  Height: + 3mm, - 5mm
- For thin layer mortar:
  Length: ± 3mm
  Width: ± 2mm
  Height: ± 1.5mm

Properties

Mean compressive strength not less than 2.9N/mm²

Designed thermal conductivity (λ) 0.11W/m.K

Specified gross dry density 470kg/m³

* May be used in situations described in A1, A2 but not in situations described in A3 of Table 13 of BS 5628: Part 3.

Widths and weights

Block weights at equilibrium density (for 440 x 215mm face dimension)											
block width (mm)	100	115	125	130	140	150	190	200	215	265	300**
block weight† (kg)	4.6	5.3	5.7	6.0	6.4	6.9	8.7	9.2	9.9	12.1	13.7
wall weight‡ (kg/m²)	57	66	72	75	80	86	109	115	123	152	172

**Manufactured to special order only

† Block weights are calculated using specified gross dry density, with a moisture content of 3% by weight added to provide the equilibrium value.

‡ Weight of erected wall (including mortar). Add 11kg/m² per side for a 2-coat lightweight plaster finish (24kg/m² for dense plaster).

Hi-Strength 7

external walls • foundations • partitions • separating walls

Strength 7.3N/mm²

Thermal conductivity 0.19W/m.K

Density 730kg/m³

Hi-Strength 7 has been specifically designed for applications such as flats of three storeys and above, offices, supermarkets and retail parks, where loading conditions require a 7.3N/mm² building block.

- Available in large format
- For use with Thermalite Thin Layer Mortar

Working dimensions

Face dimensions (mm) 440 x 215, 440 x 430

Tolerances

- For general purpose mortar:
  Length: + 3mm, - 5mm
  Width: ± 2mm
  Height: + 3mm, - 5mm
- For thin layer mortar:
  Length: ± 3mm
  Width: ± 2mm
  Height: ± 1.5mm

Properties

Mean compressive strength not less than 7.3N/mm²

Designed thermal conductivity (λ) 0.19W/m.K

Specified gross dry density 730kg/m³

Widths and weights

Block weights at equilibrium density (for 440 x 215mm face dimension)						
block width (mm)	100	140	150	190	200	215
block weight† (kg)	7.1	10.0	10.7	13.5	14.2	15.3
wall weight‡ (kg/m²)	82	115	124	157	165	177

† Block weights are calculated using specified gross dry density, with a moisture content of 3% by weight added to provide the equilibrium value.

‡ Weight of erected wall (including mortar). Add 11kg/m² per side for a 2-coat lightweight plaster finish (24kg/m² for dense plaster).

Shield

external walls • foundations • partitions • separating walls

Strength 3.6N/mm²

Thermal conductivity 0.15W/m.K

Density 600kg/m³

Shield combines all the normal qualities of Thermalite blocks with extremely high moisture resistance.

- Available in large format
- For use with Thermalite Thin Layer Mortar

Working dimensions

Face dimensions (mm) 440 x 215, 440 x 140, 440 x 430, 540 x 440†

Tolerances

- For general purpose mortar:
  Length: + 3mm, - 5mm
  Width: ± 2mm
  Height: + 3mm, - 5mm
- For thin layer mortar:
  Length: ± 3mm
  Width: ± 2mm
  Height: ± 1.5mm

Properties

Mean compressive strength not less than 3.6N/mm²

Designed thermal conductivity (λ) 0.15W/m.K

Specified gross dry density 600kg/m³

†Only available in 100mm thickness with a compressive strength of 3N/mm², manufactured to special order only.

Widths and weights

Block weights at equilibrium density (for 440 x 215mm face dimension)								
block width (mm)	75	90	100	125	140	150	190	200
block weight† (kg)	4.4	5.3	5.8	7.3	8.2	8.8	11.1	11.7
wall weight‡ (kg/m²)	52	63	70	87	98	105	133	140

† Block weights are calculated using specified gross dry density, with a moisture content of 3% by weight added to provide the equilibrium value.

‡ Weight of erected wall (including mortar). Add 11kg/m² per side for a 2-coat lightweight plaster finish (24kg/m² for dense plaster).

THERMALITE

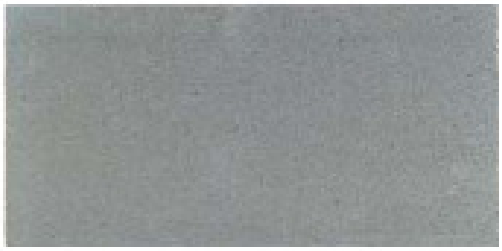
All Thermalite blocks are produced with scratch marks to identify the different range of densities in which they are produced. Please find below a guide to the product range.

Turbo: 6 scratch marks

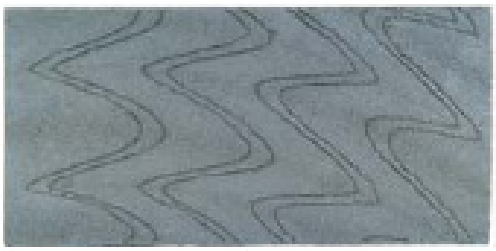
Shield: 4 pairs of scratch marks

Hi-Strength 7 and
Hi-Strength Trenchblock: 4 scratch marks

Hi-Strength 10: 2 scratch marks



Paint Grade Smooth/Hi-Strength Paint Grade Smooth: 0 scratch marks



Trenchblock/ Tongue & Groove: 4 pairs of scratch marks

Floorblock: 9 scratch marks

Party Wall: 9 scratch marks

4. Summary

Thermalite Turbo 2.8N/mm^2			
Product tested	**Average Ultimate load**	**Safe Working load**	**Characteristic Axial spacing**
SX 8	0.73kN	0.10kN	120
SX 10	2.08kN	0.30kN	120
S-H-R	1.72kN	0.24kN	210
FUR 10	2.23kN	0.32kN	210
FUR 8	1.87kN	0.27kN	210
FIS V + PBB + M10	4.60kN	1.15kN	200
FIS V + PBB + M12	5.30kN	1.32kN	250

Thermalite Shield 4.0N/mm^2			
Product tested	**Average Ultimate load**	**Safe Working load**	**Characteristic Axial spacing**
SX 8	1.13kN	0.16kN	150
SX 10	1.78kN	0.25kN	150
S-H-R	1.80kN	0.26kN	210
FUR 10	2.35kN	0.33kN	210
FUR 8	2.18kN	0.31kN	210
FIS V + PBB + M10	3.90kN	0.97kN	200
FIS V + PBB + M12	4.46kN	1.12kN	250

Thermalite Partywall 4.0N/mm^2			
Product tested	**Average Ultimate load**	**Safe Working load**	**Characteristic Axial spacing**
SX 8	1.18kN	0.17kN	120
SX 10	2.50kN	0.36kN	150
S-H-R	2.27kN	0.32kN	210
FUR 10	3.10kN	0.44kN	210
FUR 8	2.25kN	0.32kN	210
FIS V + PBB + M10	3.92kN	0.98kN	200
FIS V + PBB + M12	5.36kN	1.34kN	250

Thermalite Hi Strength 7 7.0N/mm^2			
Product tested	**Average Ultimate load**	**Safe Working load**	**Characteristic Axial spacing**
SX 8	2.68kN	0.38kN	120
SX 10	3.73kN	0.53kN	150
S-H-R	2.47kN	0.35kN	210
FUR 10	3.35kN	0.48kN	210
FUR 8	2.08kN	0.30kN	210
FIS V + PBB + M10	7.13kN	1.78kN	200
FIS V + PBB + M12	8.13kN	2.03kN	250

5 Conclusion

The variety of fixings tested means that this report provides a comprehensive guide to end users, specifiers and distributors when choosing a fixing. Choice of fixings vary due to the load required, method of installation etc.

The test results for all of the fixings tested show a good variation in ultimate loads. This allows the Engineer/Architect/End-user to have a broad range of anchors to choose from, depending on both function and load performance.

Failure of the fixings was determined by ultimate load failure or excessive displacement. With the exception for the FIS V + PBB all the fixings failed due to excessive displacement. This is technically a serviceability failure rather than and ultimate load failure. However, this value was used to ensure conservatism.

Axial spacing's vary from anchor to anchor due to their expansion or form-locking characteristics. Axial spacing's are given in the results and should be used as a guide only. It is our opinion that for expansion anchors a characteristic axial spacing should be three times the embedment depth. This is to prevent stress interference from adjacent anchors under load.

For any further information regarding the test report please contact fischer technical department. Tel: 01491 827 920